REMARKS

The Office Action of April 16, 2003 has been received and its contents carefully considered.

The Examiner has not acknowledged applicants' claim for foreign priority, or applicants' claim for domestic priority based on a provisional application. Applicants request the Examiner to make such acknowledgements.

Claims 3, 4, 10, 13, 14, 18 and 19 have been rejected under the second paragraph of 35 U.S.C. § 112 as indefinite.

The Examiner states that the units of measurement for the amount of boron nitride is indefinite in its use of the term "by mass". The Examiner states that neither the mass of the boron nitride, carbon fiber or combined total is provided, of which a percentage can be determined. The Examiner states that the metes and bounds for which patent protection is being sought, therefore, is not clear.

Applicants submit that the claims are clear.

Claims 3, 13 and 18 state that the boron nitride is present in an amount of about 2% by mass or more, based on the entire amount of vapor grown carbon fiber. Thus, the entire amount of vapor grown carbon fiber would correspond to the entire mass, that is, 100% of the mass of the vapor grown carbon fiber, and the boron nitride is present in an amount of 2% based on this entire amount. Applicants submit that one of ordinary skill in the art would understand the meaning of claims 3, 13 and 18.

With respect to claims 4, 14 and 19, they state that the amount of boron in the depth of 1 nm from the surface of the vapor grown fiber is about 10% by mass or more. Applicant have

amended claims 4, 14 and 19 to insert the phrase "based on the entire mass of the vapor grown carbon fiber", as disclosed at page 13, lines 11 to 13, of the specification. Applicants have amended claim 10 in a similar manner. See page 9 of the specification.

In view of the above, applicants submit that the claims comply with the requirements of the second paragraph of 35 U.S.C. § 112 and, accordingly, request withdrawal of this rejection.

Claims 1-5 and 11-20 have been rejected under 35 U.S.C. § 103(a) as obvious over Dasch et al or EP '062 in view of Stempin et al.

Applicants submit that these references do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

The present invention, as set forth in claim 1 as amended above, is directed to an electrical insulating vapor grown carbon fiber comprising a vapor grown carbon fiber having a fiber diameter of 0.01 to 0.5 μm, a hollow part in the center part of fiber and a boron concentration of about 1 to about 30% by mass in terms of a boron element, wherein the surface thereof is partially or entirely coated with an electrical insulating material.

Applicants have amended claim 1 to recite the hollow structure and the boron concentration. As support for these amendments, "a boron concentration of about 1 to about 30% by mass in terms of a boron element" is described at page 9 and in original claim 10, and "a hollow part in the center part of fiber" is described at page 3, line 21 to 24 of the specification.

Dasch et al and EP '062 each disclose a vapor grown carbon having a fiber diameter that is within the range 0.01 to 0.5 μm, and each disclose the combination of the carbon fiber with a synthetic resin.

The Dasch et al patent indicates at column 2, lines 23 to 25 that vapor-grown fibers are not readily wettable. The Dasch et al invention is to provide a novel method for forming a composite material containing the vapor-grown carbon fibers which enhances adhesion between the fibers and a polymeric matrix.

With respect to the Examiner's combination of Dasch et al with Stempin et al, applicants submit that one of ordinary skill in the art would not have been led to combining the teachings of these references because Dasch et al indicate that vapor grown carbon fibers are difficult to employ in composite materials, and there is nothing to indicate in Dasch et al or Stempin et al that the boron nitride of Stempin et al could be used to form a composite of boron nitride with such fibers. Dasch et al provide a specific method for enabling a synthetic resin to wet and be combined with the vapor grown fibers, but do not indicate that other materials such as boron nitride can be combined with the fibers.

Further, Dasch et al describe mixing a vapor grown carbon fiber into a thermoplastic resin, and thereby improve the mechanical strength of the resin, and provide a composition with improved electric conductivity and thermal conductivity. The method of the Dasch et al does not form an insulator layer around the carbon fiber, and, therefore, the Dasch et al carbon fiber passes heat, but Dasch et al do not produce an electric insulated carbon fiber which does not pass electricity. In addition, at column 10, lines 32-35, Dasch et al indicate that the resin composition was relatively electrically conductive. Accordingly, if the resin composition of the Dasch et al would be employed as the heat dissipation component of an electronic device, problems such as a short circuit would occur.

Turning now to EP '062, it discloses at page 2, lines 23 to 35, that vapor grown carbon fibers have difficulty in forming a composite material. The invention in EP '062 is to provide novel vapor grown carbon fibers which can be more easily combined with other materials to form composite materials. As disclosed at page 3, last paragraph, the vapor grown carbon fibers of EP '062 can be combined with a plastic material, a rubbery material, a metallic material, a ceramic material, a paint, an adhesive, or the like.

The composite materials of EP '062 can be used as highly electrically conductive materials, highly thermally conductive materials, carriers for catalysts, and so on. Example 1 of EP '062 comprises a mixture of the fiber with phenol resin, which was coated on a glass plate. Example 2 employed a polyethylene fine powder to produce a molded member. Example 3 employed polyvinylidene fluoride and 1- methyl -2- pyrrolidone to form a paste that was used to form an electrode.

EP '062 describe that by pulverizing graphitized vapor grown carbon fiber, the fibers can be added to a resin in a high density. In Example 1 of EP '062, a composite resin which has superior electric conductivity is obtained. Similar to the aforementioned Dasch et al, with this kind of resin composition, it cannot be used for heat dissipation component in an electronic device.

Stempin et al disclose carbon fibers, such as graphite fibers, that are provided with a protective boron nitride coating. Stempin et al do not describe the carbon fibers in detail. At column 5, lines 3 to 5, Stempin et al disclose a graphite fiber tow material, commercially available as Hercules AS-4 carbon fiber tow, which is coated with boron nitride.

The process for coating the carbon fibers of Stempin et al with boron nitride preferably is by vapor deposition, as is described at column 4, line 16-19. As for the condition of the vapor deposition of the coating, Stempin et al disclose that temperatures below 1000°C should be employed, preferably 900° to 950°C, and that the thickness of the obtained coating can be 0.05-1 μm or higher. In addition, at column 5, lines 3-6, Stempin et al disclose that Hercules AS-4 carbon fiber tow is used as a carbon fiber. This fiber is a PAN-based carbon fiber. See the enclosed J. Res. Natl. Inst. Stand. Technol. Vol. 100, pages 641, 642 and 659 (1995). See also the enclosed copy of an internet article on "Carbon Fibers, Carbon-Polymer Composites and Carbon-Carbon Composites". This fiber does not contain a hollow part and crystallinity of the carbon structure is insufficient. Because Stempin et al employ a vapor deposition of the coating at a temperature below 1000°C, an improvement of crystallinity of carbon structure of the fiber is not obtained.

In addition, the purposes of the Stempin et al invention are to provide a high strength and/or oxidation resistance, as disclosed at column 2, lines 21 to 28. The carbon fiber in Stempin et al is tow, and the boron nitride is covered on that surface. Stempin et al do not disclose how much of the surface is coated with boron nitride.

The purpose of the present invention is not high strength and oxidation resistance. Instead, a purpose of the present invention is to provide is an electrical insulating material. Boron nitride itself is a substance which shows an electrically insulating property, and the present invention provides an electrically insulating fiber by covering a vapor grown carbon fiber (VGCF) using boron, preferably, boron nitride. Concerning the coating area, the coating ratio is

preferably 70% or more. In addition, concerning the depth of coating, as set forth in dependent claims 4, 14, and 19, the boron quantity which exists in a depth of the 1nm from the surface is preferably about 10% by mass or more.

The carbon fiber of the present invention is a vapor grown carbon fiber (VGCF), and it has a hollow structure and high crystallinity. See the enclosed copy of a "Morinobu Endo interview, Nagano, October 26, 2002". Therefore, not only is the electrical insulating superior, but also the thermal conductivity is superior. Concerning this point, there is no disclosure or suggestion in Stempin et al.

It is thought also the VGCF which is disclosed in the Dash et al and EP '062 has a hollow structure. But, as shown as Comparative Example 1 of the specification, when B_4C was not added during the heat-treatment in a nitrogen atmosphere, the Co is 0.683. Concerning this point, there is no disclosure or suggestion in Dash et al and EP '062 or Stempin et al

Stempin et al also disclose at column 1, lines 52 to 56 that U.S. Patent No. 4,642,271 to Rice describes the use of boron nitride coatings on carbon fibers. Figure 6 of Rice discloses carbon fibers. Rice discloses at column 2, lines 57 to 61 that the fibers he employs can have a diameter of 1 to 150 microns. Rice does not disclose carbon fibers having a diameter of 0.01 to 0.5 microns as recited in the present claims. The carbon fibers of Rice are not vapor grown carbon fibers that contain a hollow part in the center of the fiber.

Applicants submit that Dasch et al, EP '062 and Stempin et al, do not provide any teaching or suggestion to use an electrically insulating coating on vapor grown carbon fiber and provide a boron concentration of about 1 to about 30% by mass in terms of a boron element.

Further, Stempin et al do not teach or disclose that a boron nitride coating can be added to a vapor grown fiber having a hollow part in the center.

In view of the above, applicants submit that the cited prior art does not defeat the patentability of the presently claimed invention and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) An electrical insulating vapor grown carbon fiber comprising a vapor grown carbon fiber having a fiber diameter of 0.01 to 0.5 μm, <u>a hollow part in the center of the fiber and a boron concentration of about 1 to about 30% by mass in terms of a boron element,</u> wherein the surface thereof is partially or entirely coated with an electrical insulating material.

4. (Amended) The electrical insulating vapor grown carbon fiber as described in Claim 2, wherein the amount of boron in a depth of 1 nm from the surface of the vapor grown carbon fiber is about 10% by mass or more<u>, based on the entire mass of the vapor grown fiber</u>.

10. (Amended) The method for producing an electrical insulating vapor grown carbon fiber as described in Claim 6, wherein the mixture of the boron compound and the vapor grown carbon fiber has a boron concentration of about 1 to about 30% by mass in terms of the boron element<u>, based on the entire mass of the vapor grown carbon fiber</u>.

14. (Amended) The electrical insulating composite material as described in Claim 12, wherein the amount of boron in a depth of 1 nm from the surface of vapor grown carbon fiber is about 10% by mass or more<u>, based on the entire mass of the vapor grown carbon fiber</u>.

19. (Amended) The heat-releasing material as described in Claim 17, wherein the amount of boron in a depth of 1 nm from the surface of vapor grown carbon fiber is about 10% by mass or more, based on the entire mass of the vapor grown carbon fiber.